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Review

Postpartum Hemorrhage: Evidence-Based Prophylaxis

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ABSTRACT

Postpartum hemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide, particularly in low- and middle-income countries. This article critically reviews pharmacological, mechanical and organizational prophylactic interventions aimed at reducing the incidence and severity of PPH. The administration of uterotonics, particularly oxytocin and misoprostol, combined with active management of the third stage of labor and the use of intrauterine tamponade devices, has shown effectiveness in immediate hemostasis and reduction of long-term complications. Standardized institutional protocols and obstetric emergency training are essential to optimize early recognition and rapid treatment of PPH, significantly improving clinical outcomes and maternal safety.

Keywords: Postpartum hemorrhage; Prophylaxis; Uterotonics; Active management; Intrauterine devices

Introduction

Postpartum hemorrhage (PPH) is defined as blood loss equal to or greater than 500 mL within the first 24 hours after vaginal delivery or 1,000 mL after cesarean section[1,2]. It is considered an obstetric emergency due to the risk of hypovolemic shock, disseminated intravascular coagulation and maternal death[3]. PPH accounts for approximately 27% of maternal deaths in developing countries and occurs in up to 10% of deliveries worldwide[4]. Risk factors include labor dystocia, uterine rupture, placenta previa or low-lying placenta, placenta accreta, preeclampsia, gestational anemia, prolonged oxytocin use during labor and a history of previous PPH. The high prevalence and severe consequences of this event have driven the continuous search for evidence-based prophylactic strategies. From a pharmacological standpoint, the administration of intra- or intravenous uterotonics immediately after fetal expulsion is the mainstay of prophylaxis.

Oxytocin is the first-line agent, recommended as a single dose of 10 IU intramuscularly or a continuous infusion of 20–40 IU in 1000 mL of 0.9% saline for up to 4 hours, reducing the incidence of significant PPH by up to 60% and decreasing the need for blood transfusions by 40%. In resource-limited settings where oxytocin stability may be compromised by the lack of a cold chain, misoprostol, a prostaglandin E1 analog, offers logistical advantages. Studies show that 600 µg of sublingual misoprostol reduces the risk of PPH by up to 50%, although it is associated with a higher frequency of thermal and gastrointestinal adverse effects, such as transient fever and nausea. Other pharmacological options, such as ergometrine (0.2 mg intramuscularly) and carboprost tromethamine (250 µg intramuscularly)[5], are indicated as alternatives or adjunct

therapies, especially in patients with contraindications to oxytocin or in refractory cases.

Ergometrine has shown similar efficacy to oxytocin but with a higher incidence of arterial hypertension and headache. Carboprost shows 70-80% efficacy in secondary PPH prophylaxis and is reserved for first-line agent failure scenarios.

In addition to pharmacological interventions, active management of the third stage of labor including delayed cord clamping, controlled cord traction and immediate uterine massage enhances uterine contractions and facilitates placental separation, reducing average blood loss by up to 30%. Active inspection of the uterus and cervix, along with bimanual uterine massage, enables early detection of atony and immediate application of direct hemostatic techniques. In cases of refractory bleeding, intrauterine tamponade devices such as the Bakri balloon offer effective mechanical tamponade, with hemostatic success rates exceeding 85% and potential to avoid invasive surgical procedures such as arterial embolization or emergency hysterectomy. Transcervical insertion and gradual balloon inflation with saline provide direct compression on the placental bed, rapidly reducing bleeding[6].

On na organizational level, the implementation of standardized institutional protocols combined with simulated obstetric emergency training has demonstrated a 20–30% reduction in response time to PPH diagnosis and significant decrease in management variability. These strategies include emergency checklists, clear role definitions within ontexto plinar teams and ontexto communication flows between obstetricians, anesthesiologists, nurses and blood banks. Given the complexity of prophylactic management, each obstetric unit must tailor recommendations to its local ontexto, ensuring systematic monitoring of clinical indicators and periodic process reviews. The combination of pharmacological, mechanical and organizational approaches forms the foundation for sustainable PPH reduction and improved maternal safety[7,8].

Objectives

This article aims to critically review the main prophylactic strategies employed in the prevention of postpartum hemorrhage (PPH), with emphasis on pharmacological, mechanical and organizational interventions based on recent scientific evidence. The goal is to identify the most effective practices for reducing maternal morbidity and mortality, promoting obstetric safety and standardization of clinical protocols.

Materials and Methods

A literature review was conducted using the databases PubMed, SciELO, Google Scholar and ScienceDirect.

Discussion

Several randomized clinical trials have demonstrated the superiority of oxytocin over placebo and other interventions, with an average reduction in blood loss of 150-200 mL and an odds ratio of 0.35 for severe PPH. Direct comparison between oxytocin and ergometrine showed similar efficacy but distinct safety profiles[9]. Ergometrine had a higher incidence of hypertension and cardiovascular adverse reactions, whereas oxytocin had few side effects when administered according to protocol[10]. The logistical resistance to using refrigerated oxytocin prompted studies on misoprostol, which proved to be a viable alternative in remote regions, with up to 50% efficacy in reducing severe PPH. However, variability in dose and route of administration oral, sublingual or rectal requires standardization and training to minimize adverse events.

The Bakri balloon and similar devices have emerged as second-line interventions for refractory PPH, with reported success rates between 85–95%. These technologies require specific training for proper insertion and recognition of complications, such as uterine perforation or balloon displacement. Systematic application of active management, including uterine massage and controlled cord traction, has been shown to reduce the duration of the third stage and average blood loss, contributing to reduced incidence of mild to moderate PPH. Visual and tactile inspection of the uterus after placental expulsion allows for early intervention in cases of atony[11].

Adapted protocols and high-fidelity simulation training have a direct hock on reducing the time between diagnosis and intervention, resulting in improved clinical outcomes[12-14]. Brazilian studies reported a 30% decrease in the rate of emergency hysterectomies and hypovolemic hock following the implementation of training programs. Prophylaxis with oxytocin and standardized protocols has been shown to reduce hospital costs by up to 25% by minimizing prolonged hospital stays and the need for transfusions. These findings support the importance of investment in medication stockpiles and continuous training[15].

Conclusion

Postpartum hemorrhage represents one of the greatest challenges in modern obstetrics, especially in settings where access to timely and effective interventions is limited. Literature analysis shows that pharmacological prophylaxis, particularly with oxytocin, is the most robust pillar in preventing PPH, significantly reducing blood loss and the need for transfusions. Alternatives such as misoprostol are valuable in settings with deficient infrastructure, although they have a more pronounced adverse effect profile. The association of agents like ergometrine and carboprost in refractory cases adds value to the therapeutic arsenal, although their use must be carefully weighed against cardiovascular risks. Active management of the third stage of labor emerges as an essential and low-cost practice that significantly contributes to the prevention of hemorrhagic complications. Controlled cord traction, immediate uterine massage and post-placental uterine inspection have a positive impact on hemostasis, reinforcing the importance of training obstetric teams for proper execution. In refractory bleeding situations, the use of intrauterine tamponade devices, such as the Bakri balloon, is a safe and effective intervention, capable of preventing more invasive surgical procedures and reducing associated morbidity and mortality. At the same time, the organizational component of health institutions plays a decisive role in the quality of response to hemorrhagic emergencies.

The implementation of standardized clinical protocols, combined with realistic simulation training and integrated team communication, reduces the time between diagnosis and intervention, improves clinical decision-making and promotes better maternal outcomes. Standardizing practices and continuous professional development are, therefore, essential measures to reduce disparities in care and ensure safe obstetric management. It is concluded that effective prevention of PPH requires a multifaceted approach adapted to local realities,

combining high-efficacy pharmacological resources, evidence-based obstetric techniques and well-structured organizational systems. Investing in professional training, continuous availability of essential medications and well-structured care protocols is essential to reduce maternal mortality and achieve consistent progress in global obstetric health. Tackling PPH, therefore, is not limited to adopting isolated measures but involves consolidating an institutional culture of safety and excellence in maternal care.

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